

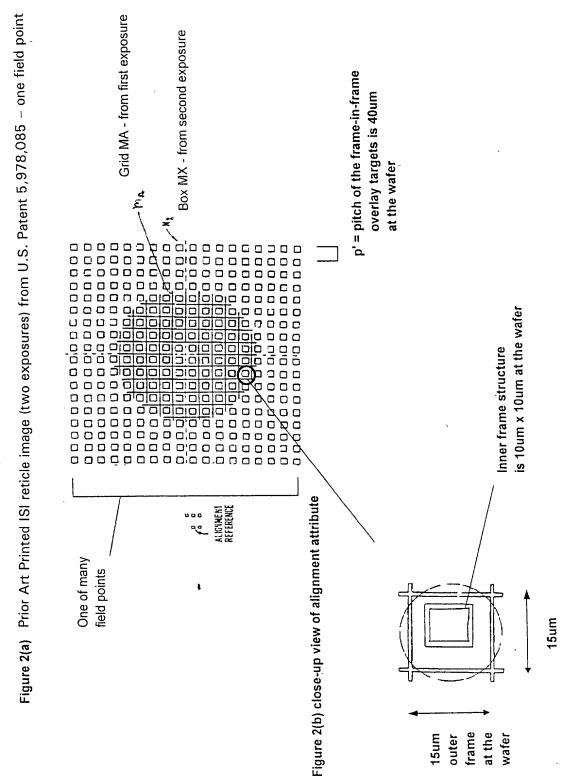
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Figure 1(e) - detail of field point the near circular region is near a 15 x 15 a 21 x 21 array of outer frame structures 550 um alignment attributes - however, structures ~400um in diameter Each field point contains array of frame-in-frame Field point number at wafer level Wafer Notch One Exposure Wafer ready for overlay Exposure field measurement embodiment of preferred

Figure 1(d) Preferred embodiment - typical wafer level exposure pattern

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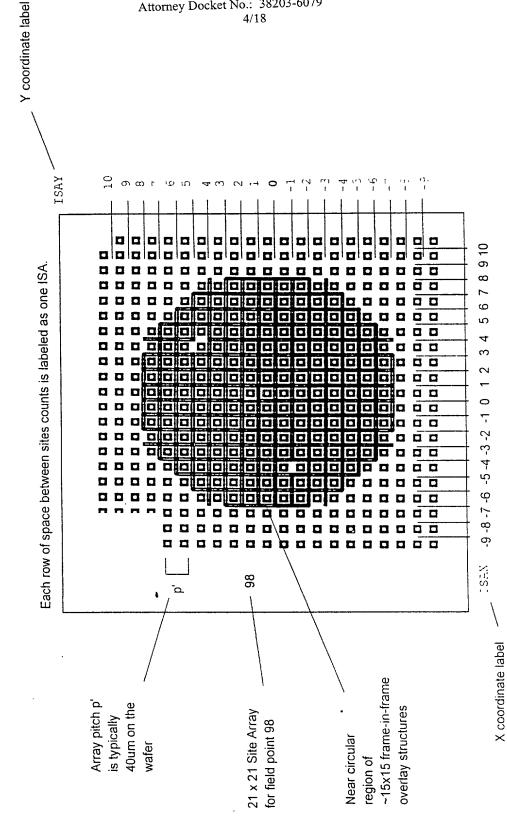
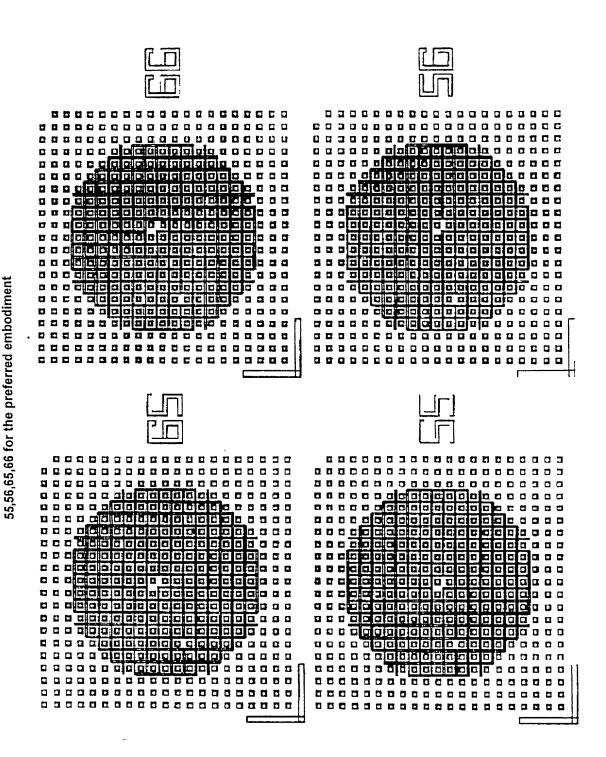


Figure 3 Diagram of ISA coordinates for a given field point

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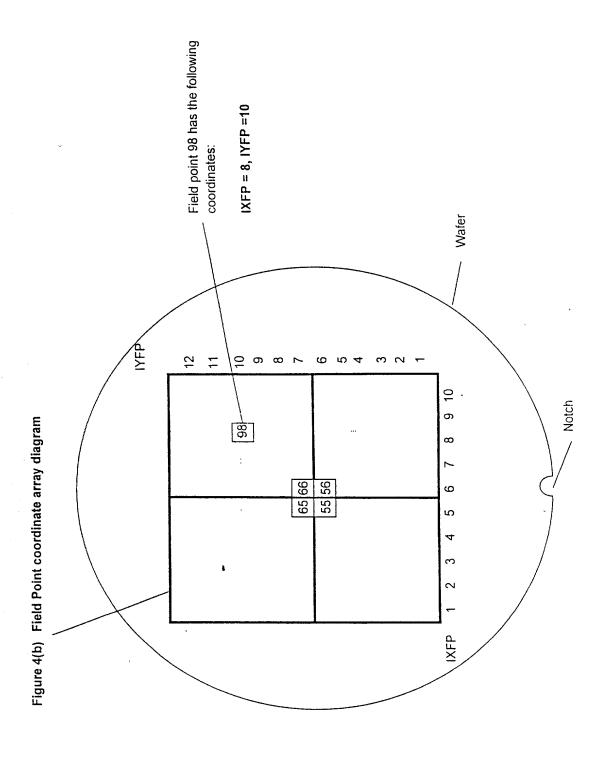
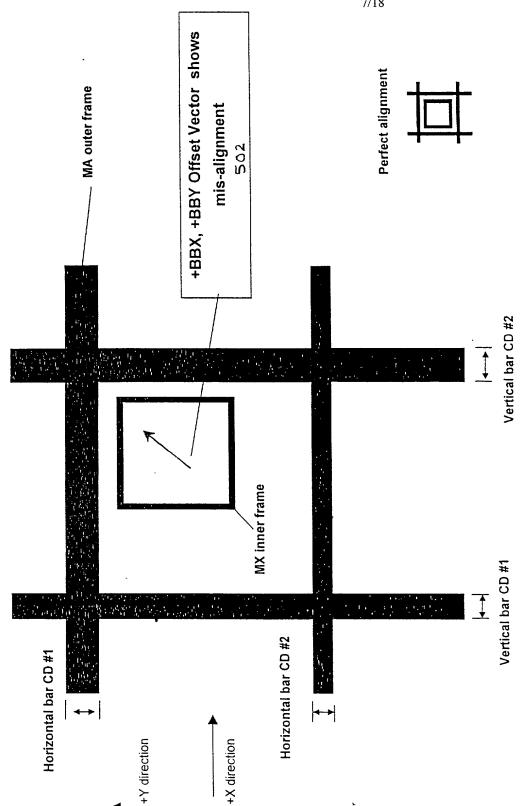


Figure 5(a) Sign convention for BBX and BBY offsets and fourth encoding scheme at wafer level

The small inner frame is shown mis-aligned to the larger outer frame this produces

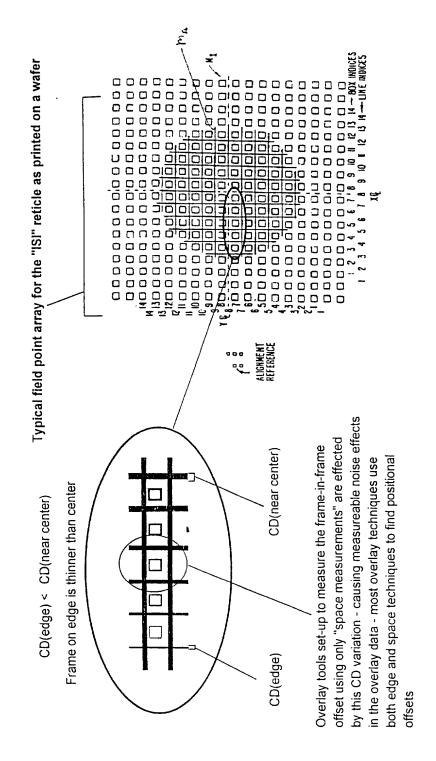
an x-shift and y-shift overlay positional offset (+BBX and +BBY)



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Figure 5(b) Typical Overlay errors



Overlay measurements using CD or edge techniques



space

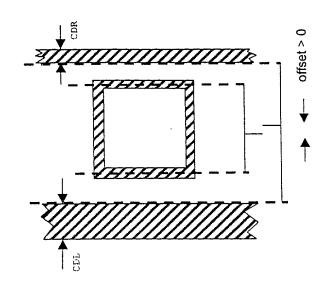
Overlay measurements using space techniques



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measurement producing non zero offset in presence of CD variation (CDL > CDR) Figure 5d, Bar in box or frame in box

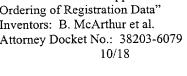


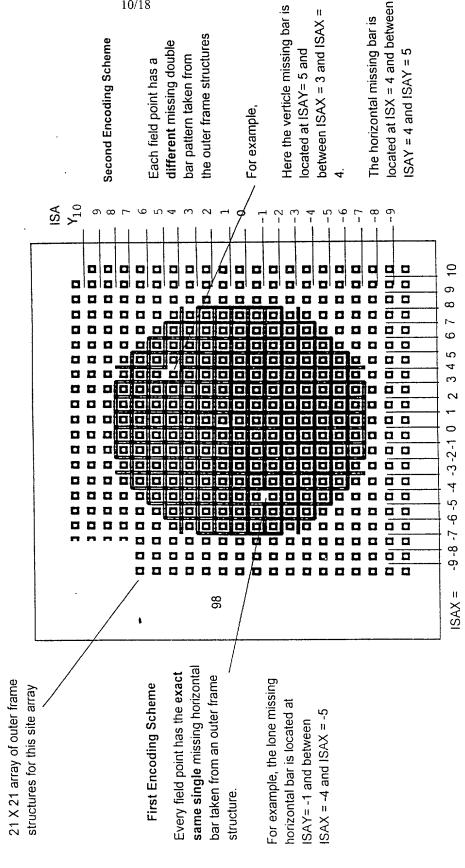
offset=0

measurement producing 0 offset in presence of Figure 5c, Bar in bar or frame in frame CD variation (CDL > CDR).

Figure 6 First two encoding schemes - missing-bar layout for field point 98

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	20 21	11/18																	
	18 19			•				-0 250 0 125	-0.250 0.1875	-0 250 0.25	-0 250 0.3125	-0 250 0 375							
	17 1					-0 188 0	-0 188 0 0625	-0 188 -0 0 125 0	-0 188 -0. 0 1875 0 1	-0 188 -0 0 25 0	-0 188 -0 0 3125 0.3	-0 188 -0 0 375 0	-0 188 0 4375	-0 188 0 5					
	16				-0 125 -0 0625	-0 125 -0 0	-0 125 -0 0 0625 0	-0 125 -0 0 125 0	-0 125 -0 0 1875 0	-0 125 -0 0 25 0	-0 125 -0 0 3125 0:	-0 125 -0 0 375 0	-0 125 -0 0 4375 0	-0 125 -0 0 5	-0 125 0 5625				
	15			-0 063 0 125	-0 063 -C	0 063 -C	-0 063 -6 0 0625 0	-0.063 -C 0 125 0	-0 063 -0 0 1875 0	-0 063 -C 0 25 (-0 063 -0 0 3125 0	-0 063 -0 0 375 0	-0 063 -(0 4375 0	.0 063 -(0 5	-0 063 -(0 5625 0	-0 063 0 625			
	4			0 000	0.000	7	ΤΟ.	0 000 -1	0.000 -0.1875 0	0 000 -4 0.25	0.000 0.3125 0	0 000 0	0 0000 -0 0 4375 0	0 000 0	0.5625 0	0 000 0			
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•	12		0 125	0 125 -0 125	0 125 -0 0625	0 125	0 125 0 0625	0 125 0 125	0 125 0.1875	0 125 0 25	0 125 0 3125	0 125 0 375	0 125 0 4375	0 125 0 5	0 125 0 5625	0 125 0 625	0 125 0 6875		
	=		0 188 -0 1875	0 188 -0 125	0 188 -0 0625	0 188 0	0 188 0 0625	0 188 0 125	0 188 0 1875	0 188 0 25	0 188 0 3125	0 188 0 375	0.188 0.4375	0 188 0 5	0 188 0 5625	0 188 0 625	0 188 0 6875		
	5		0 250 -0 1875	0 250 -0 125	0 250 -0 0625	0 250	0 250 0 0625	0 250 0 125	0 250 0 1875	0 250 0 25	0 250 0 3125	0 250 0 375	0 250 0 4375	0.250 0.5	C 250 0 5625	0 250 C 525	C 25C 0 6875		
= 0.0625	6		0 313 -0 1875	0 313 -0.125	0 313 -0 0625	0 313	0 313 0 0625	0 313 0 125	0 313 0 1875	0 313 0 25	0 313 0 3125	0 313	0 313 0 4375	0 313 0 5	0 313 0 5625	0 313 0 625	0 313 0 6875		
DS/DSOW = 0.0625	, 80			0 375 -0 125	0 375 -0 0625	0 375	0 375 0 0625	0 375	0 375 0 1875	0 375 0 25	0 375 0 3125	0 375 0 375	0 375 0 4375	0375	0 375	0.375			
	. 7			0 438 -0 125	0 438 -0 0625	0 438	0 438 0 0625	0 438 0 125	0.438 0.1875	0 438 0 25	0 438 0 3125	0 438 0 375	0 438 0 4375	0 438 0 5	0 438 0 5625	0 438 0 625		•	
14	15				0 500 -0 0625	0.500	0 500 0 0625	0.500	0 500 0 1875	0 500 0 25			0 500 0 4375	0 500 0 5	0 500 0 5625				
# O X	17_0 = 17_0 =					0 563	0 563 0 0625	0 563 0 125	0 563 0 1875	0 563 0 25	0 563 0 3125	0 563 0 375	0 563 0 4375	0 563 0 5					
	4							0 625 0 125	0 625 0 1875	0 625 0 25	0 625 0 3125	0 625 0 375							
80	3		BBx BBy																
II D	2 2																		

×

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Figure 8 location of (0,0) point of frame-in-frame data on setup reticle

IX0 IY0 FP = position within 21 x 21 array where (BBx,BBy) = (0.0) occurs

= field point number

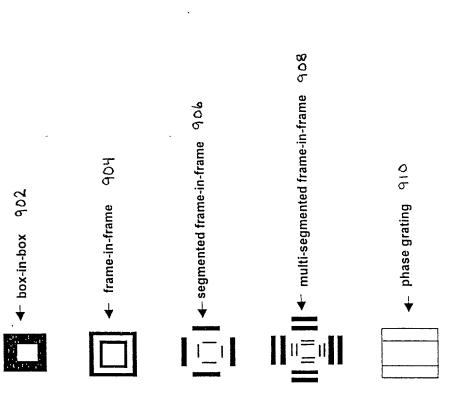
IY=	Ro	w
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=Row										
	7	8	9	10	11	12	13	14	15	11
12	17	17	17	17	17	17	17	17	1 /	1
	111	112	113	114	115	116	117	118	119	126
	7	8	ā	10	11	12	13	14	15	16
11	16	16	16	16	16	1.4	16	16	; ,	1.
	101	162	103	104	105	106	107	108	10.00	110
	7	8	9	10	11	12	13	14	15	16
10	15	15	15	15	15	15	15	15	15	15
	91	92	93	94	95	96	97	9.8	94	200
	7	8	ģ	10	11	12	13	1 4	! "	11
9	14	14	L 4	14	14	14	14	14	11	1 1
	81	82	83	84	8.5	86	87	88	8.4	90
	7	8	9	10	11	12	13	14	15	16
8	13	13	13	13	13	13	13	13	13	13
	71	72	73	74	75	76	77	78	19	80
	7	8	9	10	11	12	13	14	14	1 f
7	12	12	12	12	12	12	12	12	1.1	1.1
	61	62	63	64	65	66	67	68	64	76
	7	8	9	10	11	12	13	14	15	11
6	11	11	1.1	1.1	1.1	1.1	t i	1.1	. !	1 1
	51	52	**	51	.'.	•	٠,			1
	7	В	Ч	10	1.1	'	11	11	1	- 1
5	10	10	19	1.0	1.0	1.0	10	10	1.2	11
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4	9	9	c)	C _j	9	44	t.	14		
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2	7	1	1	7	1	1	1			
	1.1	12	13	. 14	15	16	1.7	1.8	19	*11
	7	8	Cg.	10	11	12	[{	1 }	15	1.
1	6	б	6	б	ti	6	6	11	ſ	1
	1	2		4	1,	6	1	н	1	10
	1	2	,	4	1,		1	is	1	10

IX=Col

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or completed alignment attributes Figure 9 Typical overlay patterns



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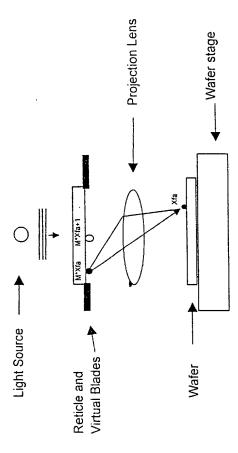
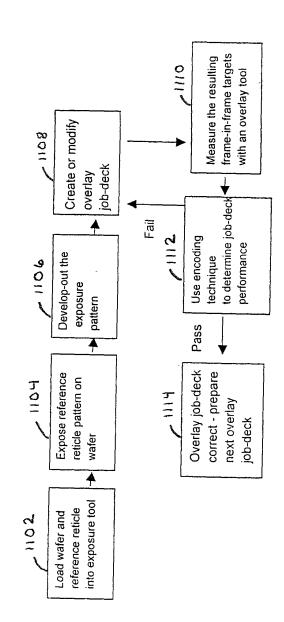


Figure 10 Photolithographic stepper or scanner system

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Figure 11 Process flow for a method of verifying proper order of a job deck.



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Figure 12 Reticle and resist frame-in-frame description for a typical ISA coordinate site ISAX, ISAY

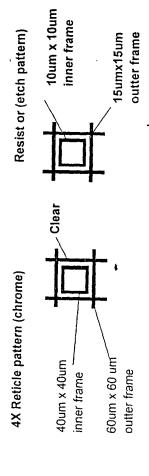


Figure 13 Centered
Frame-in-Frame structure
No shift: ISAX = 0, ISAY = 0

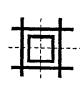
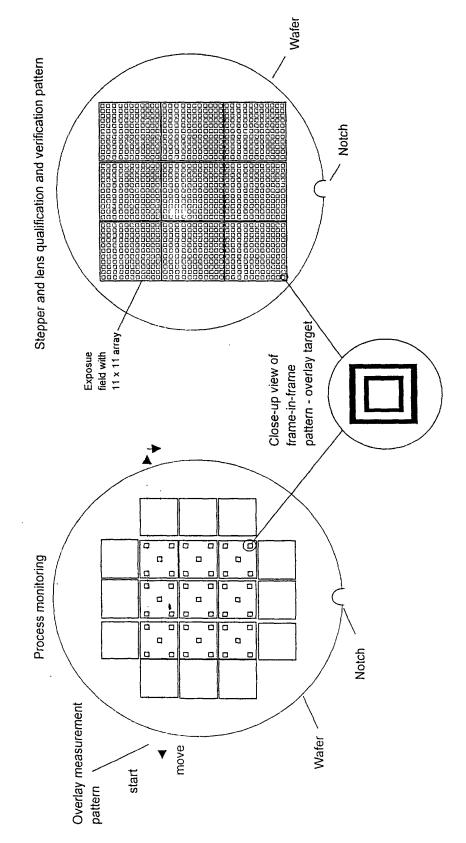


Figure 14 Prior art - exposure patterns: Process monitoring and Stepper qualification

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